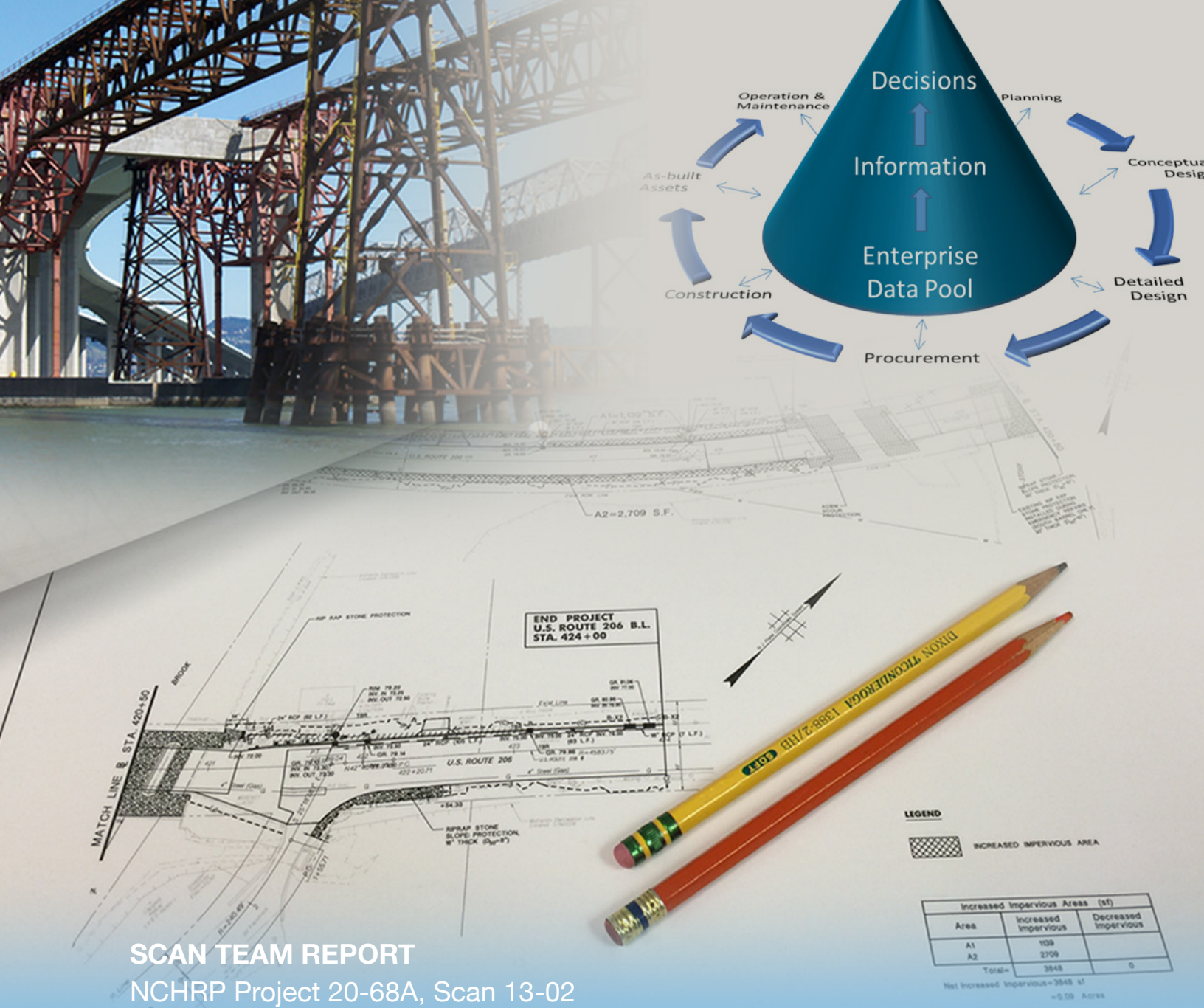

SCAN TEAM REPORT

NCHRP Project 20-68A, Scan 13-02

ADVANCES IN CIVIL INTEGRATED MANAGEMENT

Supported by the

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Executive Summary

The rapid development of information technologies is transforming how construction project information is produced, exchanged and managed throughout a transportation project's life cycle. This transformative change is accelerating due to the availability of intelligent construction systems and technologies, and the pressing need for better, faster, and smarter ways of delivering projects. With ample evidence and success stories from the vertical construction industry and some promising case study results from the highway industry, a significant improvement in data sharing among project participants and across project development stages is possible with a model-based project delivery process and digital data transfer systems. In turn, this will translate into increased productivity, efficiency, and accountability.

The Federal Highway Administration (FHWA) and three other national associations: the American Association of State Highway and Transportation Officials (AASHTO), the American Road and Transportation Builders Association (ARTBA), and The Associated General Contractors of America (AGC) have quickly captured the concept of this new business paradigm, and they defined the term Civil Integrated Management (CIM) as follows:

> *"Civil Integrated Management (CIM) is the collection, organization, and managed accessibility to accurate data and information related to a highway facility. The concept may be used by all affected parties for a wide range of purposes, including planning, environmental assessment, surveying, construction, maintenance, asset management, and risk assessment."*

Based on the discussions during scan team meetings, the 13-02 scan team decided that addressing the importance of data usage throughout the entire life cycle of a transportation facility is desirable. Furthermore, the team acknowledged that design is an integral contributor and user of life cycle data so the scan team suggests that the original definition of CIM be modified to the following:

> *"Civil Integrated Management (CIM) is the technology-enabled collection, organization, managed accessibility, and use of accurate data and information throughout the life cycle of a transportation asset. The concept may be used by all affected parties for a wide range of purposes, including planning, environmental assessment, surveying, design, construction, maintenance, asset management, and risk assessment."*

To explore the concept of CIM and the potential implementation of CIM within transportation agencies further, the Scan 13-02 team devoted two weeks to the scan during the summer of 2014. The participating department of transportation included Iowa, Michigan, New York, Texas, Utah, Virginia, and Wisconsin. Each state DOT and its contractors presented their experiences and insights into the implementation of CIM-related practices and tools.

This scan's focus area included the following:

- Technical factors
- Organization factors
- Proven, efficient intelligent construction technologies
- Construction project performance measures
- Successful partnering techniques

- Digital data to provide the information and knowledge for planning, operation, and maintenance phases
- Opportunities that would benefit an entire transportation agency
- Opportunities for collecting and using geospatial data

CIM concepts can be categorized as foundational concepts, enabling technologies, and contributing technologies. Agencies might consider first starting with some foundational concepts that facilitate CIM implementation. Next, consider enabling technologies that are highly useful in a CIM system. Contributing technologies may not be necessary for initial CIM implementation; however, they have the potential to amplify the usefulness of a CIM system. The following is a list of foundational concepts, enabling technologies, and contributing technologies.

Foundational Concepts

- Establish a data warehouse or enterprise integration core that stores data, information, and knowledge on existing transportation assets and new or planned transportation projects
- Promote innovation within the whole agency
- Ensure that information technology arrangements are responsive to agency business needs
- Enable users to obtain needed data and improve decision making
- Employ model-based design as a starting point for CIM implementation
- Consider other possible areas to jump-start CIM
- Think beyond the next customer to ensure that data remains useful during the facility's entire life cycle and throughout the enterprise
- Establish a strong geospatial foundation and consider investments in the National Spatial Reference System (NSRS)
- Use common exchange formats to facilitate wide sharing of data
- Employ information modeling within the agency
- Make the required information technology (IT) investments to support a large concept
- Collaborate with contractors and utility trade groups to enhance the usefulness of CIM and enlist support.

Enabling Technologies

- Geographic information systems (GISs)
- Three-dimensional (3D) engineered models
- Light Detection and Ranging (LiDAR)
- Global positioning systems (GPSs)
- Automated machine guidance (AMG)/automatic machine control (AMC)

- Mobile devices
- Electronic document management systems

Contributing Technologies

- Intelligent compaction (IC)
- Electronic signatures
- 4D/5D models (adding schedule/schedule and cost dimensions to 3D engineered models)

Implementation plans or frameworks should be developed to serve as case studies and examples that would help agencies in their CIM development efforts. Peer exchange workshops should be held to demonstrate data pool development efforts, data governance approaches, data exchange formats, and workflow development.

The scan team identified and is pursuing outreach activities to disseminate their findings and support further adoption of CIM.